



Ministry of Higher Education and
Scientific Research - Iraq
Al-Mustaqbal University
College for engineering and technology
Department of Biomedical Engineering



MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	ENGINEERING ANALYSIS AND NUMERICAL METHODS		Module Delivery
Module Type	BASIC		✓ Theory Lecture Lab Tutorial Practical Seminar
Module Code	UOMU0101062		
ECTS Credits	7		
SWL (hr/sem)	175		
Module Level	UGx11 UGIII	Semester of Delivery	6
Administering Department	Biomedical Engineering Dept.	College	College of Engineering
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval		Version Number	

Relation With Other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	<ol style="list-style-type: none"> 1. This program aims to support the health sector with specialized engineers who are needed to improve methods for the medical care of patients and the fruitful usage of engineering in the field of medicine. 2. To develop problem-solving skills and an understanding of engineering analysis theories through the application of techniques. 3. Providing the student with practical and theoretical information about engineering analysis. 4. Teaching the student to understand the basic laws of engineering analysis and how to model systems in their various electrical, mechanical, and chemical forms and apply these systems to biomedical appliances. 5. To build on the fundamental material introduced in Engineering Mathematics and Systems Modeling, Simulation and Computation thereby ensuring that students are equipped with the necessary analytical and computational tools to tackle advanced material in modules taught in later years. 6. To develop skills in the use of MATLAB for modeling and analysis of engineering systems. To apply computational methods to the analysis and modeling of data. 7. Providing the student with the skills of linking the relationship between systems and mathematical calculations. 8. Make students to explain state space models and transfer function models of continuous systems. 		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	<p>Projected outcome of the course are:</p> <ol style="list-style-type: none"> 1. An ability to use techniques, skills, and modern engineering tools necessary for engineering practice. 2. An ability to design and conduct experiments, as well as to analyze and interpret. 3. An ability to design a system, component, or process to meet desired needs. 4. An ability to identify, formulates, and solves engineering problems. 5. Knowledge of contemporary issues. 		

	<ol style="list-style-type: none"> 6. An ability to use techniques, skills, and modern engineering tools necessary for engineering practice. 7. Demonstrate the ability to identify and implement appropriate numerical methods to solve specific mathematical problems. 8. Students will be able to mathematical methods in statistics and probabilities and their role in a variety of problems in engineering 9. Students will demonstrate the ability to numerically solve problems in linear and non-linear algebra and calculus.
<p>Indicative Contents المحتويات الإرشادية</p>	<p>Introduction to engineer analysis conceptions, practical application, Solution of linear second order ordinary differential equations and the role of the complementary function and particular integral, the characteristic equation using Laplace transform .</p> <p>Mathematical modelling of systems, mechanical modelling, electrical modelling, chemical modelling.</p> <p>In this course, you will be introduced to the mathematical analysis of numerical problems such as those that are encountered in many disciplines, including the physical sciences and engineering. You will learn to select, configure and use suitable computational tools with appropriate numerical methods for integration and optimization, simulation techniques, applications of differential equations and presentation of data. You will also learn to use MATLAB in order to explore and apply the mathematical techniques taught in the lectures.</p>
<p>Learning and Teaching Strategies استراتيجيات التعلم والتعليم</p>	
<p>Strategies</p>	<p>The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of experiments involving some sampling activities that are interesting to the students.</p>

<p>Student Workload (SWL) الحمل الدراسي للطالب</p>			
<p>Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل</p>	<p>123</p>	<p>Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا</p>	<p>7</p>

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	0			
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction to classification of differential equations/ engineering analysis
Week 1	Introduction to numerical solution and counting errors/ numerical methods
Week 2	Separable variables differential equations, Homogeneous differential equations (reducible to separable DE)/ engineering analysis
Week 2	Numerical solution of ordinary functions/ numerical methods
Week 3	Reducible to homogeneous DE, biomedical examples/ engineering analysis
Week 3	Bisection numerical method and its program/ numerical methods
Week 4	Exact differential equations, Reducible to exact differential equations(Integrating factor)/ engineering analysis
Week 4	Secant numerical method and its program/ numerical methods
Week 5	Linear differential equations, Reducible to linear differential equations(Bernoulli equation), Second order differential equation reduced to first order differential equation/ engineering analysis
Week 5	False position numerical method and its program/ numerical methods
Week 6	Application of Ordinary Differential Equations in Biomedical/ engineering analysis
Week 6	Newton Raphson numerical method and its program/ numerical methods

Week 7	Introduction to Laplace transforms/ engineering analysis
Week 7	Fixed point iterative numerical method and its program/ numerical methods
Week 8	Inverse Laplace transforms, The solution of simultaneous differential equations using Laplace transforms/ engineering analysis
Week 8	Forward Finite difference operators and its numerical solution/ numerical methods
Week 9	Fourier series for periodic functions of period 2π / engineering analysis
Week 9	Central and backward Finite difference operators and its numerical solution/ numerical methods
Week 10	Fourier series for a non-periodic function over range 2π / engineering analysis
Week 10	Lagrange numerical method and division method/ numerical methods
Week 11	Even and odd functions and half-range Fourier series/ engineering analysis
Week 11	Curve Fitting/ numerical methods
Week 12	Complex numbers/ engineering analysis
Week 12	Integration by Numerical Methods /1-Trapezoidal method/ numerical methods
Week 13	Applications of complex numbers, De Moivre's theorem/ engineering analysis
Week 13	Integration by Numerical Methods /2- 1/3 Simpson's rule/ numerical methods
Week 14	Introduction to partial differential equations/ engineering analysis
Week 14	Integration by Numerical Methods/3- 3/8 Simpson's rule/ numerical methods
Week 15	Some important engineering partial differential equations/ engineering analysis
Week 15	Solution of ordinary differential equations: Taylor, Runge-kutta, Euler, modified Euler/ numerical methods
Week 15	Introduction to Z- transforms/ engineering analysis
Week 15	Numerical Solution of system of equations such as: Gaussian elimination method Gauss Jordan method/ numerical methods
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	

Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Higher Engineering Mathematics/John Bird. 2. Fundamentals of Differential Equations/R. Kent Nagle, Edward B. Saff and Arthur David Snider. 3. Higher Engineering Mathematics/H.K.DASS 4. Differential Equations Demystified. 5. Advanced Engineering Mathematics/ ERWIN KREYSZIG 6. Engineering Mathematics-I/P. Sivaramakrishna Das	Yes
Recommended Texts	Schaums' outline Series.	No

APPENDIX:

GRADING SCHEME				
مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria

Fail Group (0 – 49)	FX – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

